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Frequently Asked Questions about radiation facts and health effects

1. What is radiation?

Radiation is a form of energy. It comes from man-made sources such as x-ray machines, from the sun and outer space, and from some radioactive materials such as uranium in soil. Radiation travels as rays, waves or energetic particles through air, water or solid materials.

Radioactive materials are composed of atoms that are unstable. As unstable atoms become stable, they release excess energy (called "radiation") through a process called radioactive decay or radioactivity. The time required for a radioactive substance to lose 50 percent of its activity by decay is called its half-life.

The most common types of radiation emissions are alpha, beta and gamma rays.

Alpha particles can be shielded by a sheet of paper or by human skin. But if materials that emit alpha particles are inhaled, ingested or enter your body through a cut in your skin, they can be very harmful.

Beta particles cannot be stopped by a sheet of paper. Some beta particles can be stopped by human skin, but some need a thicker shield (like wood) to stop them. Just like alpha particles, beta particles can also cause serious damage to your health if they are inhaled or swallowed. For example, some materials that emit beta particles might be absorbed into your bones and cause damage if ingested.

Gamma rays are the most penetrating of these three types of radiation. Gamma rays will penetrate paper, skin, wood, and other substances. Like alpha and beta particles, they are also harmful if inhaled, ingested or absorbed. To protect yourself from gamma rays, you need a shield at least as thick as a concrete wall. This type of radiation causes severe damage to your internal organs. (X-rays fall into this category, but they are less penetrating than gamma rays.)

2. How can I be exposed to radiation?

Small quantities of radioactive materials occur naturally in the air we breathe, the water we drink, the food we eat, and in our own bodies. People receive some background radiation exposure each day from the sun, from radioactive elements in soil and rocks, from household appliances (such as television sets and microwave ovens), and from medical and dental x-rays. Even the human body itself emits radiation. These levels of natural and background radiation are normal.

Radiation doses that people receive are measured in units called "rem" or "sievert." (One sievert equals 100 rem.) Scientists estimate that the average person in the United States receives a dose of about one-third of a rem per year. Eighty percent of typical human exposure comes from natural sources, such as sunlight. The remaining 20% comes from artificial radiation sources, primarily medical x-rays.

3. **What are the health effects of exposure to radiation?**

Radiation's health effects can be mild, such as reddening of the skin, or very serious, such as cancer or early death. Radioactive materials dispersed in an urban area pose a serious health hazard. Strong sources of gamma rays can cause acute radiation poisoning or even fatalities at high doses. Long-term exposure to low levels of gamma radiation can cause cancer. Alpha particles (such as americium) small enough to be inhaled can damage people's lungs and lead to an increased risk of cancer.

The degree of damage to the human body depends on:

- The amount of radiation absorbed by the body (the dose)
- The type of radiation
- The route of exposure
- The length of time a person is exposed

Exposure to very large doses of radiation may cause death within a few days or months. Acute radiation syndrome (ARS), or radiation sickness, is usually caused when much of the human body is exposed to a high dose of radiation over the course of a few minutes. Survivors of the Hiroshima and Nagasaki atomic bombs and firefighters responding to the Chernobyl nuclear power plant event in 1986 experienced ARS. The immediate symptoms of ARS are nausea, vomiting and diarrhea; later, bone marrow depletion may lead to weight loss, loss of appetite, flu-like symptoms, infection and bleeding. The survival rate depends on the radiation dose. For those who do survive, recovery may take a few weeks to two years.

Exposure to lower doses of radiation may lead to an increased risk of cancer, cataracts or decreased fertility. Radiation exposure, like exposure to the sun, is cumulative. The damage from exposure to radiation may not be apparent for many years.

Children are more sensitive to radiation than adults. Exposure to human embryos or fetuses is of special concern because they are extremely sensitive to radiation.

4. **How can I protect myself from radiation?**

The longer a person is exposed to radiation and the closer the person is to the source of radiation, the greater the risk. There are three basic ways to reduce your exposure:

- Time: Decrease the amount of time you spend near the source of radiation.
- Distance: Increase your distance from the radiation source
- Shielding: Increase the shielding between you and the radiation source.

Shielding is anything that creates a barrier between people and the radiation source. Depending on the type of radiation, effective shielding can be something as thin as a plate of window glass or may need to be as thick as several feet of concrete. Being inside a building or a vehicle can provide shielding from some kinds of radiation.

Remember that any protection, however temporary, is better than none at all. The more shielding, distance and time you can take advantage of, the better. Although radiation cannot be detected by the senses (sight, smell, etc.), scientists can detect even the smallest levels of radiation with a range of instruments.

5. Will potassium iodide protect me?

Taking potassium iodide (KI) pills for protection against a dirty bomb is not recommended. These tablets, now widely available, are promoted by commercial companies for defense against everything from a nuclear plant accident to a dirty bomb explosion. However, KI pills are not likely to offer protection from the radiation spread by a dirty bomb and could actually be harmful to people's health. KI pills help protect the thyroid gland from the damaging effects of radioactive iodine, but they are of no help if the dirty bomb contains any other form of ionizing radiation. There are many other radioactive sources that could be used instead of, or along with, radioactive iodine, and KI tablets would be useless against them. Many people could also be harmed by the high concentration of iodine in KI because of allergies or other conditions.

6. What are some sources and uses of radioactive materials?

Radioactive materials are widely used in hospitals, research labs, industry and construction sites for such things as diagnosing and treating illnesses, sterilizing equipment, and irradiating food. Radioactive byproduct material in the United States is regulated by either state or federal laws. The Nuclear Regulatory Commission, together with 32 states which regulate radioactive material, have over 21,000 organizations licensed to use such materials for these purposes.

Other man-made radioactive materials come from nuclear power and weapons sites. In the United States, radioactive waste is located at more than 70 commercial nuclear power sites in 31 states. Enormous quantities also exist overseas, especially in Europe and Japan.

Medical procedures, including diagnostic X-rays, nuclear medicine and radiation therapy, make up the most significant source of man-made radiation exposure to the general public. Other legal uses of radioactive materials include industrial radiography, manufacture of gauging devices, gas chromatography, and well logging. It is used in consumer products such as smoke detectors (americium), "exit" signs, static eliminators, and luminous watch dials. Some examples of radioactive materials are cesium, americium, plutonium, and strontium.